

**MINUTES OF THE  
47<sup>TH</sup> MEETING OF WORKING GROUP OF NIH  
HELD AT NIH, ROORKEE, DURING 23-24 OCTOBER 2018**

The 47<sup>th</sup> meeting of the Working Group of NIH was held at NIH, Roorkee, during 23-24 October 2018 under the Chairmanship of Director, NIH. The list of the participants of the meeting is given in Annexure-I.

**ITEM NO. 47.1: OPENING REMARKS BY THE CHAIRMAN**

Dr. S K Jain, Director, NIH & Chairman, WG welcomed the Working Group members and the Scientists of the Institute. The Chairman informed the house about the expectation of the government that the research at NIH should lead to solution of practical problems.

The Chairman then requested the Working Group members to give their general observations, suggestions and remarks on the scientific activities of the Institute. These are summarized below:

<b>S N</b>	<b>Member</b>	<b>Suggestion(s)</b>
1	Dr. D R Sena	<ul style="list-style-type: none"> <li>▪ Suggested use of ecological index</li> <li>▪ Advised consideration of the effect of CO<sub>2</sub> while using carrying out SWAT modelling</li> </ul>
2	Dr. D K Singh	<ul style="list-style-type: none"> <li>▪ Suggested consideration of hydrological zoning while estimating groundwater recharge potential</li> <li>▪ Also consider CO<sub>2</sub> values in RCP results</li> </ul>
3	Dr. U K Sinha	<ul style="list-style-type: none"> <li>▪ Include isotopic analysis in most of the studies</li> </ul>
4	Dr. M J Nandan	<ul style="list-style-type: none"> <li>▪ Advised study on limnology of urban lakes</li> </ul>
5	Dr. S P Aggarwal	<ul style="list-style-type: none"> <li>▪ Develop flood early warning system for Uttarakhand</li> <li>▪ Work for urban floods</li> <li>▪ Suggested developing methodology on the use of extreme events for design of structures</li> </ul>
6	Dr. George Abe	<ul style="list-style-type: none"> <li>▪ Advised internal discussion before presentation of inter-divisional projects/studies</li> </ul>
7	Prof. Vimal Mishra	<ul style="list-style-type: none"> <li>▪ Include list of publications during the last 3 years</li> <li>▪ Publish papers in reputed journals</li> <li>▪ Each project should be judged by its scientific outcome</li> <li>▪ Consider working for operational hydrology forecasts (e.g. real time ET, SM)</li> <li>▪ Develop internal data repository</li> </ul>
8	Prof. K K Singh	<ul style="list-style-type: none"> <li>▪ Develop calibration facility for hydromet equipment</li> <li>▪ Organize training of lab staff and technicians</li> </ul>
9	Prof. M L Kansal	<ul style="list-style-type: none"> <li>▪ Show outlay of studies</li> </ul>
10	Dr. Bhishm Kumar	<ul style="list-style-type: none"> <li>▪ Create data repository, and link with NIH website</li> </ul>
11	Dr. Sadhana Malhotra	<ul style="list-style-type: none"> <li>▪ Carry out cost-benefit analysis for projects/studies</li> <li>▪ Consider ecological viability of studies</li> <li>▪ Models developed should become source of revenue</li> <li>▪ Organize programs for development of soft skills</li> </ul>

After taking the views of the members and their self-introduction, the Chairman asked the Member-Secretary to take up the agenda of the meeting.

**ITEM No. 47.2: CONFIRMATION OF THE MINUTES OF 46<sup>th</sup> MEETING OF THE WORKING GROUP**

The 46<sup>th</sup> meeting of the Working group was held during 8-9 Feb., 2018. The minutes of the meeting were circulated to all the members and invitees vide letter No. RMOD/WG/NIH-10 dated 19 March 2018. No Comments were received. The members confirmed the Working Group minutes.

**ITEM No. 47.3: ACTION TAKEN ON THE DECISIONS/RECOMMENDATIONS OF THE PREVIOUS WORKING GROUP MEETING**

Dr V C Goyal gave a brief account of the actions taken on the recommendations/ decisions of the 46<sup>th</sup> working group meeting.

**ITEM Nos. 47.4: PRESENTATION AND DISCUSSION ON THE STATUS AND PROGRESS OF THE WORK PROGRAMME FOR YEAR 2018-19**

The Member-Secretary requested the respective Divisional Heads to present the progress of studies carried out during 2018-19. Accordingly, the progress of various studies and sponsored projects was presented by all Scientific Divisions during the two day deliberations of the Working Group. The Division wise minutes of each study/project presented during the meeting are given next.

**ENVIRONMENTAL HYDROLOGY DIVISION**

**PROGRESS OF WORK PROGRAMME 2018-19**

SN	Study	Recommendations/Comments
<b>Internal Studies (Continuing)</b>		
1.	Development of Habitat Suitability Curves for the Aquatic Species of Western Himalayan Streams and Assessment of Environmental Flows  <b>Study Group:</b> Pradeep Kumar and C. K. Jain <b>Duration:</b> 3 Years (04/16-03/19)	No comments
<b>Sponsored Projects (Continuing)</b>		
1.	Environmental Assessment of Aquatic Ecosystem of Upper Ganga Basin  <b>Study Group:</b> C. K. Jain (PI), Manohar Arora, M. K. Sharma, P. Kumar, R. Singh and D. S. Malik (GKU) <b>Duration:</b> 5 Years (04/16-03/21)	No comments
2.	Ground Water Quality Assessment with Special Reference to Sulphate Contamination in Bemetara District of Chhattisgarh State and Ameliorative Measures  <b>Study Group:</b> <b>NIH:</b> M. K. Sharma (PI), C. K. Jain, Surjeet Singh, Pradeep Kumar <b>WRD, Raipur:</b> A. K. Shukla (PI), Ashok Verma, P. C. Das <b>CGWB, Raipur:</b> A. K. Patre <b>Duration:</b> 03 Years (09/17-08/20)	<ul style="list-style-type: none"> <li>• Dr. Bhishm Kumar suggested to collect the samples from deep aquifers which are being used by the public for quality aspect. Dr. Sharma replied that samples from deep aquifer will be collected in next sampling.</li> <li>• Dr. Uday Kumar Sinha enquired how quality can be improved by modelling. Dr. Surjeet Singh supplemented that modelling will help in generating future scenarios and consider the impact of recharge.</li> </ul>

3.	<p>Water Quality Assessment of Southwest Punjab Emphasizing Carcinogenic Contaminants and their Possible Remedial Measures</p> <p><b>Study Team:</b> Rajesh Singh (PI), Pradeep Kumar, M. K. Sharma, Sumant Kumar  <b>Partner:</b> Water Resources Organization, Punjab  <b>Sponsored by:</b> NHP-PDS  <b>Duration:</b> 3 Years (09/17 – 08/20)</p>	<ul style="list-style-type: none"> <li>• Dr. Sharad Jain and Dr. Bhisim Kumar suggested including the analysis of probable carcinogens in other routes of exposure that may lead to cancer.</li> </ul>
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### APPROVED WORK PROGRAMME FOR THE YEAR 2018-19

SN	Study	Recommendations/Comments
<b>Internal Studies (Continuing)</b>		
1.	<p>Development of Habitat Suitability Curves for the Aquatic Species of Western Himalayan Streams and Assessment of Environmental Flows</p> <p><b>Study Group:</b> Pradeep Kumar and C. K. Jain  <b>Duration:</b> 3 Years (04/16-03/19)</p>	-
<b>Internal Studies (New)</b>		
2.	<p>Impact of Climate Change on Runoff and Sediment Yield for a Major Tributary of River Brahmaputra</p> <p><b>Study Group:</b> Swapnali Barman (PI) and J. V. Tyagi  <b>Collaborator:</b> Prof. R. K. Bhattacharya, IIT Guwahati  <b>Duration:</b> 3 years (11/18 to 10/21)</p>	<ul style="list-style-type: none"> <li>• Instead of going for downscaling of GCM data, available downscaled data can be used for the study.</li> <li>• More time should be given to develop the SWAT model.</li> <li>• Thorough literature survey is to be made to understand the sediment characteristics of river Brahmaputra.</li> </ul>
<b>Sponsored Projects (Continuing)</b>		
1.	<p>Environmental Assessment of Aquatic Ecosystem of Upper Ganga Basin</p> <p><b>Study Group:</b> C. K. Jain (PI), Manohar Arora, M. K. Sharma, P. Kumar, R. Singh and D. S. Malik (GKU)  <b>Duration:</b> 5 Years (04/16-03/21)</p>	-
2.	<p>Ground Water Quality Assessment with Special Reference to Sulphate Contamination in Bemetara District of Chhattisgarh State and Ameliorative Measures</p> <p><b>Study Group:</b>  <b>NIH:</b> M. K. Sharma (PI), C. K. Jain, Surjeet Singh, Pradeep Kumar  <b>WRD, Raipur:</b> A. K. Shukla (PI), Ashok Verma, P. C. Das  <b>CGWB, Raipur:</b> A. K. Patre  <b>Duration:</b> 03 Years (09/17-08/20)</p>	-
3.	<p>Water Quality Assessment of Southwest Punjab Emphasizing Carcinogenic Contaminants and their</p>	-

Possible Remedial Measures	
<b>Study Team:</b> Rajesh Singh (PI), Pradeep Kumar, M. K. Sharma, Sumant Kumar <b>Partner:</b> Water Resources Organization, Punjab <b>Sponsored by:</b> NHP-PDS <b>Project Cost:</b> 65.6 Lakh <b>Duration:</b> 3 Years (09/17 – 08/20)	

## **GROUND WATER HYDROLOGY DIVISION**

Dr. N. C. Ghosh, Scientist 'G' & Head presented a brief overview, status of studies and activities carried out by the division since the 46<sup>th</sup> Working Group meeting held in February, 2018. He gave an account of sponsored and consultancy projects ongoing and completed, and also planned activities. Dr. Ghosh informed that one in-house R&D study and ten sponsored studies were approved in the work program for the year 2018-19. In addition, scientists in the division have responsibilities of implementation and management of DSS(P) developed under HP-II for different states and also in developing the groundwater module of the “Integrated Hydrologic Model” under an ongoing NHP study with IIT Kharagpur.

The number of research papers published in journals, lectures delivered in training courses and the number of M.Tech/Ph.D students guided/guiding during the period were also reported. Dr. Vimal Mishra from IIT Gandhinagar enquired about the reasons of limited number of publications during the period despite good works being done by the scientists. Dr. Ghosh informed that the papers published in journals (not presented/published in Symposia/Conferences) had only been indicated; papers under review had not been included in the list.

The study-wise progress reported and suggestions emerged are given below:

1. **Project Ref. Code: NIH/GWD/NIH/15-19: Peya Jal Suraksha - Development of Six Pilot Riverbank Filtration Demonstrating Schemes in Different Hydrogeological Settings for Sustainable Drinking Water Supply**

Dr. N. C. Ghosh (PI) briefed about the study and progress made so far on the project. Currently four sites; Agra & Mathura in U. P. along Yamuna river, Berhara village in Arrah district in Bihar along the Ganga river, and Varaha River at Vishakapatnam are being pursued for developing RBF wells through respective state water supply department. Money for taking up the Phase-II of the Agra and Mathura site involving installation of submersible pumps, establishment of pump house and other facilities has been provided to U.P. Jal Nigam Agra unit and the works are likely to start. For other two sites, Arrah and Vishakapatnam, geophysical survey's have been completed and moneies for the Phase-I had been provided to the respective state govt. utility groups.

2. **Project Ref. Code: NIH/GWD/NIH/16-20: Ground water fluctuation and conductivity Monitoring in Punjab- New evidence of groundwater dynamics in Punjab from high frequency groundwater level and salinity measurements**

It was reported that water loggers were installed in the Saroya, Bhogpur and Sultanpur Lodhi in the month of May, 2018 considering the physiography, geomorphology and hydro-geological conditions of the area. Data are being monitored on a regular interval of time. The results for conductivity data showed that there were some irregular trends. e.g. in Saroya, the conductivity fluctuations were about 40  $\mu$ S/cm while at Kapurthala the fluctuations were within 10  $\mu$ S/cm.

3. Project Ref. Code: NIH/GWD/NMSHE/16-20: Study of river - aquifer interactions and groundwater potential in the upper Ganga basin up to Dabrani

**Dr. Surjeet Singh (PI) presented the** objectives, methodology, achievements and expected outcome of the study. He also described the geology and soils, status of installation of piezometers, water sampling & analysis being carried out, future plans and results of water quality and isotopic analysis. PI informed that many isotopic data points are not lying along the GMWL, for which Director NIH advised to test the samples again.

4. Project Ref. Code: NIH/GWD/NIH/16-19: Grey Water to Blue Water – Natural Treatment Techniques for Transforming Wastewater into Sustainable Useable Water

Dr. N. C. Ghosh (PI) informed that because of non-suitability of land provided by the Civil Administration along the Solani river in the Khanapur village for installation of the proposed scheme and due to the resistance from the local villagers, the development & persuasion of the field experimental works are under hold since May, 2017 and continuation of the project in such condition is under question. As such, no progress towards the activities of the project except procurement of ICP-OES for water quality analysis has been made.

5. Project Ref. Code: NIH/GWD/DST/18-20: Future Secular Changes and Remediation of Groundwater Arsenic in the Ganga River Basin-FAR GANGA

Dr. N. C. Ghosh (India Lead) presented the progress made so far on the project funded under the Indo-UK - DST NERC-EPSRC Newton Bhabha Fund. He informed that the project is of 4 x 4 consortium partner from each country and the Indian partners are NIH (Indian Lead); IIT Kharagpur, IIT Roorkee; and Mahavir Cancer Sansthan, Patna and that of UK partners are University of Manchester (UK Lead), British Geological Survey, Salford University; and Univ. of Birmingham.

While presented the objectives, and hypotheses to be tested in the project, Dr. Ghosh informed that two review meetings in India to decide responsibilities, common sampling protocol, sharing of data/information, and other aspects took place in Patna and Varanasi. Two rigorous sampling campaigns, Bijnor and Moradabad aiming to examine the possibility of establishing 'Natural Field Experimental' site in the upper Ganga plain had been carried out and most of the samples had been analyzed from the IIC-IIT Roorkee and CSSRI-Karnal. No positive results for establishing the field experimental site either at Bijnor or Moradabad area were obtained. The future targeted area for the field experimental site has planned for Ballia district in U.P.

6. Project Ref. Code: NIH/GWD/DST/18-20: Impact of Rainwater Harvesting on Groundwater Quality in India with Specific reference to Fluoride and Micro-pollutants

Dr. Anupma Sharma (India Lead PI) presented the study approved under the India-UK DST- NERC-EPSRC Water Quality Research Programme (Newton Bhabha fund). The research gaps, objectives of the study, and the work packages were presented. The study sites in which field investigations are being conducted were discussed. The details of the three-day Indo-UK consortium meeting held in Jaipur was also informed.

7. Project Ref. Code: NIH/GWD/PDS/18-21: Ganges Aquifer Management in the context of Monsoon Runoff conservation for sustainable River Ecosystem Services- A Pilot study

**Dr. Surjeet Singh (PI) presented** the background, statement of the problem, objectives, methodology and future plans of the study. In the previous 46<sup>th</sup> WG Meeting, Dr. M. L. Kansal, Professor, had IITR suggested a minor change in the name of PDS, which was replied by PI. No comments/suggestions were made.

8. **Project Ref. Code: NIH/GWD/PDS/18-20: Assessment of impacts of groundwater salinity on regional groundwater resources, current and future situation in Mewat, Haryana – possible remedy and resilience building measures**

Dr. Gopal Krishan (PI) presented the background, statement of the problem, objectives, methodology, progress and future plans of the study. Dr. D. R. Sena, Principal Scientist, IISWC, Dehradun advised to do the trend analysis of water level and cumulative rainfall departure Dr. Bishm Kumar and Dr. U. K. Sinha advised to do the sampling for isotopes (stable and tritium) to monitor the saline zone ingress into fresh water zone.

9. **Project Ref. Code: NIH/GWD/PDS/18-20: Hydro-geochemical Evolution and Arsenic Occurrence in Aquifer of Central Ganges Basin**

Mr. Sumant Kumar (PI) presented the objectives, methodology, achievements and expected outcome of the study. A Working Group member suggested that Maxent or similar software may be used for spatial analysis of arsenic distribution.

10. **Project Ref. Code: NIH/GWD/PDS/18-20: Integrated Management of Water Resources for Quantity and Quality in Upper Yamuna Basin upto Delhi**

Dr. Anupma Sharma (PI) presented the new study taken up under the Centre of Excellence for Hydrologic Modeling in National Hydrology Project. She informed in brief about the background of the study and the project partners. The project entails large data processing, field investigations and modeling studies pertaining to surface water and groundwater flows, contaminant transport and water resources management. The progress made in respect of data collection and processing, field experiments and hydrologic modeling was presented. It was suggested by Working Group Members that based on the understanding gained about the field processes during the course of the project, improvisations may be attempted in the respective modules of hydrologic models.

11. **Project Ref. Code: NIH/GWD/NIH/18-19: Application for Conjunctive use management of SW & GW in Saryu Nahar Pariyojna, U.P. using “Strategic Basin Planning for Ganga River Basin”**

Ms. Suman Gurjar explained the methodology and different modules used in the integrated system. She also informed that the integrated system is still not fully updated and presently the final version is not working properly. There are issues in running and customizing the network schematization, and she is trying to get the solution with the consultant team.

It was informed by Ms. Gurjar that when the updated version of integrated system is received and found to work properly, this study will be taken up further.

The work program of the division for the year 2018-19, as discussed in the Working Group meeting, is given below.

**WORK PROGRAM FOR THE YEAR 2018-19**

S. No.	Project	Project Team	Duration & Status	Funding Source
1. NIH/GWD/NIH/15-18	Peya Jal Suraksha - Development of Six Pilot Riverbank Filtration Demonstrating Schemes in Different Hydrogeological Settings for Sustainable Drinking Water Supply	N.C. Ghosh (Lead), C.P. Kumar, B. Chakraborty, Y.R.S. Rao, Anupma Sharma, Surjeet Singh, Sumant Kumar, Gopal Krishan, Suman Gurjar, Anju Choudhury, Sanjay Mittal, Ram Chandar	2-1/2 year (11/15 – 4/18) Extended by one year. <b>Status: In progress.</b>	Sponsored by MoWR, RD & GR under Plan Fund.

2. NIH/GWD/BGS/16-20	Ground water fluctuation and conductivity Monitoring in Punjab- New evidence of groundwater dynamics in Punjab from high frequency groundwater level and salinity measurements	<b>From : NIH, Roorkee</b> Gopal Krishna, (PI) Surjeet Singh, C. P. Kumar, N.C Ghosh <b>From : BGS, UK</b> Dr. Dan Lapworth (PI) Prof. Alan MacDonald	03 Years (01/16-11/20) <b>Status: In progress.</b>	<b>Sponsored by</b> BGS, UK
3.NIH/GWD/NMSHE/16-20	Study of river - aquifer interactions and groundwater potential at selected sites in the upper Ganga basin up to Dabrani.	Surjeet Singh (PI), N.C. Ghosh, R. J. Thayyen, Sudhir Kumar, Manohar Arora, Gopal Krishan,	5 year (01/16–12/20) <b>Status: In progress.</b>	Sponsored by DST under NMSHE SP-8.
4. NIH/GWD/NIH/16-19	Grey Water to Blue Water – Natural Treatment Techniques for Transforming Wastewater into Sustainable Useable Water	N.C. Ghosh (Lead), Anupma Sharma, Surjeet Singh, Sumant Kumar, Suman Gurjar, Anju Chaudhury, Sanjay Mittal, Ram Chandar, etc.	3 years (11/16-10/19) <b>Status: In hold.</b> <b>Partners:</b> IIT Bombay UJS, D. dun	Sponsored by NWM, MoWR, RD & GR
5.NIH/GWD/DST/18-20	Future Secular Changes and Remediation of Groundwater Arsenic in the Ganga River Basin- <b>FAR GANGA</b>	<b>NIH-Team:</b> N. C. Ghosh (India Lead) Surjeet Singh; Sumant Kumar; Gopal Krishan; Suman Gurjar <b>Other India partners:</b> IIT Roorkee; IIT Kharagpur; & Mahavir Cancer Sansthan, Patna. <b>UK- Partners:</b> Univ. of Manchester; BGS; Salford University; Univ. of Birmingham.	<b>3 years</b> (01/18–12/20) <b>Status: In progress.</b>	DST-Newton Bhabha- NERC- India- UK Water Quality Research Programme.
6.NIH/GWD/DST/18-20	Impact of Rainwater Harvesting on Groundwater Quality in India with Specific reference to Fluoride and Micro-pollutants.	<b>NIH-Team:</b> Anupma Sharma (Indian Lead); Sumant Kumar; Gopal Krishan; Suman Gurjar and M. K. Sharma <b>Other Indian partners:</b> IIT Ropar & IIT Jodhpur. <b>UK Partner:</b> Cranfield University School of Water, Energy and Environment; Cranfield University	<b>3 years</b> (01/18–12/20) <b>Status: In progress.</b>	DST-Newton Bhabha- NERC- India- UK Water Quality Research Programme.
7. NIH/GWHD/PDS/18-22	Ganges Aquifer Management in the context of Monsoon Runoff conservation for sustainable River Ecosystem Services- A Pilot study	Surjeet Singh, (PI), N.C Ghosh, Sudhir Kumar, C. P Kumar, Suman Gurjar, Gopal Krishan <b>Implementing Agency:</b> GW Deptt., Govt. of UP	04 Years (03/18-02/22) <b>Status: In progress.</b>	Sponsored by NHP under PDS
8. NIH/GWHD/PDS/18-20	Assessment of impacts of groundwater salinity on regional groundwater resources, current and future situation in Mewat, Haryana –	<b>NIH, Roorkee, India</b> Gopal Krishan (PI), N. C. Ghosh, Surjeet Singh, C.P. Kumar <b>IIT-Roorkee</b>	03 years (01/18-12/20) <b>Status: In progress.</b>	Sponsored by NHP under PDS

	possible remedy and resilience building measures	M.L. Kansal, Brijesh Yadav (PI) <b>Sehgal Foundation, Gurgaon</b> Lalit Mohan Sharma		
9. NIH/GWHD/PD S/18-20	Hydro-geochemical Evolution and Arsenic Occurrence in Aquifer of Central Ganges Basin	Sumant Kumar (PI), N.C. Ghosh, Sudhir Kumar, Rajesh Singh, Gopal Krishan, Anju Chaudhary, Ram Chander <b>Partner Organization</b> MWRD, Bihar <b>Collaborator</b> Brijesh Yadav, IIT Roorkee N.S Maurya, NIT Patna	03 years 01/18-12/20 <b>Status: In progress.</b>	Sponsored by NHP under PDS
10.NIH/GWD/PD S/18-20	Integrated Management of Water Resources for Quantity and Quality in Upper Yamuna Basin upto Delhi.	<b>NIH Team:</b> Anupma Sharma (PI) N.C Ghosh, Sanjay K. Jain, Archana Sarkar, M.K. Sharma, L.N. Thakural, Sumant Kumar, Suman Gurjar <b>Partner Organization:</b> Sanjeev Bansal (C.E, IWRD Haryana), Amod Kumar (Tech. Coord., GWD U.P), S.E. YBO, CWC New Delhi	04 years 04/18-03/22 <b>Status: In progress.</b>	Special Project under "Centre of Excellence"
11. NIH/GWD/NIH/18-19	Application for Conjunctive use management of SW & GW in Saryu Nahar Pariyojna, U.P. using "Strategic basin Planning model for Ganga River Basin"	Suman Gurjar (PI), Jyoti Patil (Co-PI), N.C. Ghosh, Anupma Sharma, Sumant Kumar, Surjeet Singh	1 Year (04/18–03/19) <b>Status: In progress</b>	Internal Funding.

### **HYDROLOGICAL INVESTIGATIONS DIVISION**

Dr Sudhir Kumar, Scientist-G and Head of the H. I. Division presented the brief details of various studies being carried out under the H. I. Division along with details about the number of research papers published/accepted for publication/communicated and analytical work carried out at the Nuclear Hydrology Laboratory. He also informed about the technology transfer activities organized/proposed by the Division.

**Table 1: Status of studies of HI Division**

<b>Type of study/Project</b>	<b>Continuing in Studies</b>	<b>New studies proposed</b>	<b>Total</b>
Internal Studies	0	0	0
Sponsored Projects	6	1	7
Consultancy Projects	7	1	8
Total	13	2	15

The progress of studies was presented by the respective P.I. of the study. The actions suggested by the working group for various studies are as follows:



**SPONSORED PROJECTS:**

SN	Project	Duration	Funding	Status	Action(s) Suggested
1.	Understanding of hydrological processes in Upper Ganga basin by using isotopic techniques	5 Years (04/16-03/21)	NMSHE Project	Continuing Study	No specific action suggested
2.	Rejuvenation of Springs and Spring-fed Streams in Mid-Himalayan Basin using Spring Sanctuary concept	3 Years (06/16 - 05/19)	Project with GBPIHE	Continuing Study	No specific action suggested
3.	Dating very old ground waters of deeper aquifers in Ganga Plains, India	3 Years (06/16 - 05/19)	IAEA	Continuing Study	No specific action suggested
4.	Chemical & Isotopic Characterization of Deep Aquifer Groundwater of Middle Ganga Basin	3 ½ year (1/18 – 6/21)	PDS under NHP	Continuing Study	No specific action suggested
6.	Development of a comprehensive plan for conservation and sustainable management of Bhimtal and Naukuchiatal lakes, Uttarakhand	3 Years (1/18 – 12/20)	PDS under NHP	Continuing Study	No specific action suggested

**WORK PROGRAMME FOR THE YEAR 2018-2019**

SN.	Project Title	Study Team	Duration	Remarks
<b>INTERNAL STUDIES:</b>				
<b>SPONSORED PROJECTS:</b>				
1.	Understanding of hydrological processes in Upper Ganga basin by using isotopic techniques	SuhasKhobragade (PI) Sudhir Kumar Rajesh Singh M. Arora R. J. Thayyen S.K. Verma	5 Years (04/16-03/21)	NMSHE Project

2.	Rejuvenation of Springs and Spring-fed Streams in Mid-Himalayan Basin using Spring Sanctuary concept	Sudhir Kumar (PI) S.K. Verma	3 Years (06/16 - 05/19)	Project with GBPIHE
3.	Dating very old ground waters of deeper aquifers in Ganga Plains, India	M. Someshwar Rao (PI) Sudhir Kumar C.K. Jain S.K. Verma	3 Years (06/16 - 05/19)	IAEA under CRP
4.	Chemical & Isotopic Characterization of Deep Aquifer Groundwater of Middle Ganga Basin	Sudhir Kumar (PI) C.K. Jain M. Someshwar Rao S.K. Verma	3 ½ year (1/18 – 6/21)	PDS under NHP
5.	Integrated Study on groundwater dynamics in the coastal aquifers of West Bengal for sustainable groundwater management	M. Someshwar (PI), Sudhir Kumar S.K. Verma A. R. Senthil Kumar V. S.Jeyakanthan	3 ½year (1/18 – 6/21)	PDS under NHP
6.	Development of a comprehensive plan for conservation and sustainable management of Bhimtal and Naukuchiatal lakes, Uttarakhand	Suhas Khobragade Sudhir Kumar	3 Years (1/18 – 12/20)	PDS under NHP
7	Climate resilient conservation & data management of spring water sources by strengthening monitoring mechanisms in drought prone areas of Sikkim	Sudhir Kumar Suhas Khobragade	6 months (11/18 – 04/19)	UNDP-India <b>(New Project)</b>

## **SURFACE WATER HYDROLOGY DIVISION**

### **WORK PROGRAM FOR THE YEAR 2018-19**

<b>ONGOING STUDIES( Sponsored )</b>			
1.NIH/SWHD/NIH/16-21	Hydrological modeling in Alaknanda basin and assessment of climate change impact	A.K. Lohani Sanjay K. Jain Archana Sarkar V.S. Jeyakanthan L.N. Thakural	<b>Sponsored by NMSHE</b> 5 years (April 2016 to Mar. 2021)
2.NIH/SWHD/NIH/17-20	Water efficient irrigation by using SCADA system for medium irrigation project (MIP) Shahnehar	R.P. Panday J.P. Patra Rajesh Singh N.K. Bhatnagar	<b>PDS under NHP</b> 3 years (Dec 2017-Dec 2020)
3.NIH/SWHD/NIH/17-19	Impact Assessment of Climate Change on Water Resources and Agriculture in Banas basin in Western India using Climate change Indicators (CII's). Approval for signing the sub-contract with SMHI	Archana Sarkar Surjeet Singh T. Thomas	1.5 years (Sep. 2017 to Feb. 2019)

	and transfer of funds to NIH has not been received. Therefore, NIH continues in the consortium as “In Kind Partner”. The objectives of CII development and script writing will be taken up by the core team at SMHI with help from NIH.		
4.NIH/SWHD/NIH/14-18	Effect of Changing Global Tropospheric Temperature on Asia-Pacific Monsoon Circulation and Rainfall Fields across India	Ashwini Ranade	<b>Sponsored by SERB-DST</b> 4 years (Oct. 2014 to Nov. 2018)
<b>ONGOING STUDIES ( Internal )</b>			
5.NIH/SWHD/NIH/17-21	Development of regional relationships for water availability analysis and flood estimation for lower Godavari basin Subzone 3(f)	Sanjay Kumar Rakesh Kumar J. P Patra Pankaj Mani	4 years (April 2017 to March 2021)
6.NIH/SWHD/NIH/15-19	Study of Hydrological Changes in selected watersheds in view of climate change in India	L.N. Thakural D.S. Rathore Surjeet Singh Sanjay Kumar Jain Sharad Kumar Jain	4 years (April 2015 to March 2019)
7.NIH/SWHD/NIH/17-20	Development of regional methods for design flood estimation in Uttarakhand	J.P. Patra Rakesh Kumar Pankaj Mani Sanjay Kumar	3 years (April 2017 to March 2020)
8.NIH/SWHD/NIH/18-21	Evaluation of seasonal extreme rain events across river basins of India in 3D global temperature change scenario	Ashwini Ranade Archana Sarkar	3 years (April 2018 to March 2021)
<b>NEW STUDIES</b>			
9.NIH/SWHD/NIH/18-20	Assessment of climate change impact on water availability and agriculture in part of Banas basin	Archana Sarkar Surjeet Singh Suman Gurjar Sunil Gurrapu	2 years (Nov 2018 to October 2020)
10.NIH/SWHD/NIH/18-21	Evaluation of the influence of low-frequency atmosphere-ocean oscillations on annual floods in the watersheds of the Indian subcontinent	Sunil Gurrapu Ashwini Ranade J.P. Patra	3 years (Nov 2018 to March 2021)
11.NIH/SWHD/NIH/18-20	Evaluation of Water Quality of Government Schools in Roorkee Block, District Haridwar	N. K. Bhatnagar M. K. Sharma L. N. Thakural Reena Rathore	2 years (Oct 2018 to Sep. 2020)

S. No.	Title of Project/Study, Study Group, Start/ Completion Dates	Status and Recommendations/Suggestions
<b>SPONSORED STUDIES</b>		
1.	<p>Hydrological modeling in Alaknanda basin and assessment of climate change impact (Ongoing).</p> <p style="text-align: center;"><b><u>Study Group:</u></b></p> <p>A.K. Lohani Sanjay K. Jain Archana Sarkar V.S. Jeyakanthan L.N. Thakural</p> <p><b>DOS:</b> Jan. 2016 <b>DOC:</b> Dec. 2020</p>	<p>Dr. Sanjay Kumar Jain, Co-PI of the project presented the progress of the study. He mentioned that various maps such as landuse map, DEM, river network, snow cover area maps have been prepared. Furthermore, temporal meteorological data have been collected for the study basin. VIC model has been setup for the study basin. Recently flow data of various gauging sites have been received from CWC and the calibration and fine-tuning of the model with the available data is in progress. He mentioned that the progress of the study is as per the schedule.</p>
2.	<p>Water efficient irrigation by using SCADA system for medium irrigation project (MIP) Shahnehar (Ongoing) PDS under NHP.</p> <p style="text-align: center;"><b><u>Study Group:</u></b></p> <p>R.P. Panday J. P. Patra Rajesh Singh N.K. Bhatnagar</p> <p><b>DOS:</b> Dec. 2017 <b>DOC:</b> Dec. 2020</p>	<p>Dr. R.P. Pandey, PI of the project reported that this study has been taken up in collaboration with Department of Irrigation &amp; Public Health Engg. (I&amp;PHE), Hydrology C&amp;M Division, Himachal Pradesh. NIH team has conducted field visit of the Shahnehar and identified experimental sides and collected data/information in respect of this study. The objectives of this study are to assess water availability at headworks and devise a suitable approach to improve irrigation water use efficiency in Shah Nehar Project (SNP) and automation of the irrigation water supply system based on real time crop water demands. The proposed methodology and the work component include develop a system of water supply database of quantum of water used to each beneficiary so the charges can be levied accordingly; devising a possible system of change in cropping pattern owing to real time monitoring of available water at various reaches of the canal; evaluation of land and water management intervention to minimize water losses throughout the canal and distribution system, water courses and in the field application to enhance the water use efficiency; devising a mechanism for equitable distribution of water to the farmers in each crop period from head to tail reaches. Comparison of Water Efficient Irrigation approach with the conventional system and to identify and evaluation of intervention to minimize water losses throughout the canal and distribution system, water courses and in the field application to enhance the water use efficiency. The deliverables of the study will be estimates of water availability at headwork's and irrigation water requirements for various crops a different growth stages &amp; time period; quantification of irrigation water loss in different conveyance &amp; distribution systems, field channels, and irrigation application method; identification of components of irrigation system needing intervention to enhance water use efficiency etc. Further the progress was reported.</p>

		The working group members suggested to take care of between theft of water from canal as it is common problem in command areas in the country. Also, they asked about the present conveyance efficiency. Dr Pandey informed that the canals in the entire command are lined and the lining is in very good and sustainable condition with high conveyance efficiency.
3.	<p>Impact assessment of climate change on water resources and agriculture in Banas basin in Western India using climate change Indicators (CII's) (Ongoing).</p> <p style="text-align: center;"><b><u>Study Group:</u></b></p> <p>Archana Sarkar Surjeet Singh T. Thomas</p> <p><b>DOS:</b> Sep. 2017 <b>DOC:</b> Feb. 2019</p>	Approval for signing the sub-contract with SMHI and transfer of funds to NIH has not been received. Therefore, NIH continues in the consortium as "In Kind Partner". The objectives of CII development and script writing will be taken up by the core team at SMHI with help from NIH
4.	<p>Effect of Changing Global Tropospheric Temperature on Asia-Pacific Monsoon Circulation and Rainfall Fields across India (Ongoing).</p> <p style="text-align: center;"><b><u>Study Group:</u></b></p> <p>Ashwini Ranade</p> <p><b>DOS:</b> Oct. 2014 <b>DOC:</b> May 2018</p>	Dr. Ashwini Ranade, PI of the project presented the objectives and current status of the project. She also presented some important results of the study that have been obtained in last six months. The working group members appreciated the work on determination of onset and withdrawal of monsoon circulation and monsoon rains over 19 subdivisions of India.
<b>INTERNAL STUDIES</b>		
5.	<p>Development of regional relationships for water availability analysis and flood estimation for lower Godavari basin (3f) (Ongoing).</p> <p style="text-align: center;"><b><u>Study Group:</u></b></p> <p>Sanjay Kumar Rakesh Kumar J. P. Patra Pankaj Mani</p> <p><b>DOS:</b> April 2017 <b>DOC:</b> March 2021</p>	Dr. Sanjay Kumar presented the background, objectives and methodology. He stated that the study specifically focuses on developing design flood estimation methods for partially gauged or un-gauged regions based on the concept of regionalization using L moments approach. The study would also develop regional relationships between parameters of the Nash and Clark IUH models and physiographic characteristics of the basin. He mentioned that at site frequency analysis based on L-moments approach for eleven sites has been completed. He stated that data preparation and analysis for other objectives is in progress. Prof. Vimal Mishra mentioned about the availability of gridded rainfall satellite data and inquired why there is a need to specify these basins as ungauged. It was replied that when river flow data are not available for various locations the catchments are considered as ungauged catchments. It was also stated that flood hydrographs for some of the gauged catchments of the study areas may be estimated by calibrating and validating catchment models such as NAM. Using the parameters of the model and rainfall data, flood hydrographs of nearby ungauged catchments would be estimated.

6.	<p>Study of hydrological changes in selected watersheds in view of climate change in India (Ongoing).</p> <p style="text-align: center;"><b><u>Study Group:</u></b></p> <p>L.N. Thakural S. Rathore Surjeet Singh Sanjay Kumar Jain Shard Kumar Jain</p> <p><b>DOS:</b> April 2015 <b>DOC:</b> March 2019</p>	<p>Dr. L.N. Thakural, PI presented the objectives, methodology and the status of the study. The GIS database created to meet out the objectives of the study using Digital Elevation Model (DEM) and satellite imagery for flow accumulation, stream network, watershed boundary, land use / land cover thematic maps in addition to soil map for the four watersheds have been prepared. Spatio-temporal analysis of hydro-meteorological data using parametric and non-parametric approaches for the Ramganga, Bina and Chaliyar river basins was also presented. The outcome/ results of hydrological models (NAM and SWAT) calibrated and validated for the river basins i.e. Ramganga, Bina, Chaliyar and Dhadhar river basins were presented. For studying the impact of climate change, gridded rainfall and temperature data, historical NCEP/NCAR reanalysis data (observed predictors) and GCM Predictor grid boxes for the four river basins processed to generate Representative Concentrations Pathways (RCP) namely RCP 2.6 RCP 4.5, RCP 6 and RCP 8.5 using statistical downscaling model (SDSM) were presented.</p> <p>Dr. Sena, ICAR-IISWC, Dehradun suggested to use the range of carbon concentration values while defining the land use/land cover input in SWAT model along with the RCP scenarios.</p>
7.	<p>Development of regional methods for design flood estimation in Uttarakhand (Ongoing).</p> <p style="text-align: center;"><b><u>Study Group:</u></b></p> <p>J.P.Patra Rakesh Kumar Pankaj Mani Sanjay Kumar</p> <p><b>DOS:</b> April 2017 <b>DOC:</b> March 2020</p>	<p>Mr. Jagadish Prasad Patra presented the the objectives and the progress made in carrying out the study. He explained the flood frequency analysis carried out using L-moments approach. Further the progress made in the non-stationary extreme value analysis was presented. The uses of estimated design floods for designing bridges, embankments and flood plain mapping were also presented. It was informed that aspect of climate change will also be considered in rainfall frequency analysis. It was informed that daily rainfall data of 33 raingauge stations collected from IMD along with gridded rainfall data from 1901 to 2013 are being used the study. It was also informed that request has been made to CWC for providing short interval rainfall and discharge data which will be used for developing regional Clark and Nash IUH models along with GIUH.</p>
8.	<p>Evaluation of seasonal extreme rain events across river basins of India in 3D global temperature change scenario (Ongoing).</p> <p style="text-align: center;"><b><u>Study Group:</u></b></p> <p>Ashwini Ranade Archana Sarkar</p> <p><b>DOS:</b> April 2018 <b>DOC:</b> March 2021</p>	<p>Dr. Ashwini Ranade, PI presented the objectives, work plan and current status of the study. She presented a few important results from first objective. Working Group noted the work on updation of eleven major and nine independent minor river basin rainfall series and the trend analysis results to understand recent year changes in rainfall pattern.</p>

**NEW STUDIES ( Internal)**

<p>9.</p>	<p>Assessment of Climate Change Impact on Water Availability and Agriculture in part of Banas basin.</p> <p align="center"><b><u>Study Group:</u></b></p> <p>Archana Sarkar Surjeet Singh Suman Gurjar Sunil Gurrapu</p> <p><b>DOS:</b> Dec. 2018 <b>DOC:</b> Dec. 2020</p>	<p>Dr Archana Sarkar, PI presented the background and objectives of the study. The Banas river basin upto Bisalpur dam and the irrigation command located in the State of Rajasthan in western India has been selected as the study area. Trend analysis of the historical &amp; future patterns of rainfall and temperature time series in the study area will be carried out using modified Mann-Kendall's technique and Sen's Slope method. The future data time series will be taken from the GCM downscaled data of the Copernicus website which consists of data of 19 GCMs under two RCPs (RCP4.5 &amp; RCP 8.5). Rainfall-runoff modelling in the catchment of Bisalpur dam will be carried out using SCS curve number method or MIKE NAM model depending on the availability of discharge data. After the calibration of the rainfall-runoff method, estimation of inflow and water availability in the form of dependable flows in Bisalpur reservoir will be carried out. The assessment of crop water requirements for the various crops grown in the selected commands/basin shall be carried out based on the FAO CROPWAT software based on the crop coefficients during the various crop growth stages and effective rainfall. Using the GCM downscaled data of precipitation and temperature, future water availability as well as future crop water requirement will be assessed. Based on this analysis, the gaps between the demand and supply can be ascertained so as to decide the quantum of additional water required to satisfy the unmet demands. Working group found the study to be a useful input for the PMKSY scheme of Government of India and suggested to prepare a policy paper at the end of the study.</p>
<p>10.</p>	<p>Evaluation of the influence of low-frequency atmosphere-ocean oscillations on annual floods in the watersheds of the Indian subcontinent.</p> <p align="center"><b><u>Study Group:</u></b></p> <p>Sunil Gurrapu Ashwini Ranade J P Patra</p> <p><b>DOS:</b> Dec. 2018 <b>DOC:</b> Dec. 2021</p>	<p>Mr. Sunil Gurrapu, PI of the study presented the hypothesis of the proposed study, its objectives and tentative methodology. The primary objective of this study is to evaluate the influence of low-frequency atmosphere-ocean oscillations on the annual floods or annual peak flows in several watersheds of the Indian subcontinent. Since, it has been established that the Indian monsoon is significantly influenced by such teleconnections, e.g. Pacific Decadal Oscillation (PDO), El Niño-Southern Oscillation (ENSO), Indian Ocean Dipole (IOD) etc., the objective of this study is based on the hypothesis that the streamflow, i.e. the response of a watershed to the precipitation received, is also influenced by these teleconnections. Major data requirements for this study include daily streamflow and reservoir operation or rule curves. Suggestions and feedback from the committee was requested and the following suggestions were made. Dr. Vimal Mishra, IIT Gandhinagar appreciated the idea and made few suggestions to improvise the project and address some concerns regarding the data requirements. The first suggestion was related to the length of the available streamflow datasets. Since the streamflow data</p>

		<p>is available for a maximum of 30 years only, teleconnections with lower periodicity should be considered. He cautioned that although Indian monsoon is significantly correlated to low-frequency atmosphere-ocean oscillations, it may not be true in the case of annual floods since the streamflow is not very well correlated with the rainfall. However, he advised to do a feasibility study before making conclusions.</p> <p>Director, NIH raised a concern over the availability or reliability of the data related to the reservoir operations or rule curves. He indicated that the naturalization of regulated rivers may seem impossible with irregularities in the actual reservoir operations. Dr. Vimal Mishra suggested that the study should be first carried out for an unregulated river stretch (preferably upstream) or for a stretch with minimal regulation.</p>
11.	<p>Evaluation of Water Quality of Government Schools in Roorkee Block, District Haridwar.</p> <p style="text-align: center;"><b><u>Study Group:</u></b></p> <p>N. K. Bhatnagar M. K. Sharma L. N. Thakural Reena Rathore</p> <p><b>DOS:</b> Dec. 2018 <b>DOC:</b> Dec. 2020</p>	<p>The study was presented by Mr. N K Bhatnagar and undermentioned points were raised:</p> <p>Dr Sinha from BARC queried whether the study was a demand of Education Department? Have they contacted NIH or an initiative of NIH. It was informed that this problem was raised by Deputy Education Officer of Roorkee Block and accordingly the study has been taken up. Dr Sinha asked whether the amelioration will be done by NIH. It was informed that this may be done by school authorities. Dr K K Singh suggested that bacteriological testing also should be done. Dr M K Sharma replied in affirmation and added if any bacteria are found, simply boiling the water is the treatment.</p>



## WATER RESOURCES SYSTEMS DIVISION

### **SUGGESTION/ COMMENTS RECEIVED FROM MEMBERS**

Dr. Sanjay K Jain, Sc. G and Head, presented an overview of the division – scientific strength, the ongoing studies, sponsored & consultancy studies, technical publications and training courses organized. Thereafter scientists of the division presented their studies. Following are the comments received from working group on the presentations of the various studies.

**PI: Dr. M. K. Goel, Scientist “G”**

**1. Study title: NIH\_Basin – A WINDOWS based model for water resources assessment in a river basin (Ongoing)**

Dr. M. K. Goel (MKG) presented the study. After giving a brief background and methodology of the model for the new members, the details of analytical options that have been added were presented. Subsequently, a run of the model was demonstrated through some forms specifying crops and hydraulic structure attributes and the utility of WINDOWS interface was shown. MKG informed that though it is envisaged to address the sedimentation and water quality issues in future, no more modifications are planned for the time being and study report along with the model is in progress for submission.

Dr. S. P. Agarwal appreciated for the efforts of NIH in this direction and enquired about the availability of the model. MKG clarified that it is planned to put the system on NIH web site for its wider applicability and use.

**2. Study title: National Mission for Sustaining the Himalayan Ecosystem (NMSHE) (Ongoing)**

For the information of new members, MKG made a general presentation of the NMSHE project. Subsequently, presentation for seven sub-projects of NMSHE (in which Scientists of WRS Division are involved) were made.

**Sub-project – 1:** Development of a project website and hydrological database in Upper Ganga Basin (PI-Dr. M. K. Goel, Sc-G)

With regard to SP-1, Dr. A. K. Saraf enquired about the use of digitization of contours and preparation of DEM. MKG informed that though DEMs have been downloaded from various sources (SRTM, ASTER, CARTOSAT, ALOS), it is generally recommended to use the DTM. Further, contour-generated DEMs can be used to define the cross-sections for the GLOF-modeling studies. It is planned to compare various DEMs with the contour-generated DEM and analyze their differences. Finally, the drainage network derived from various DEMs would be compared for its accuracy and sub-basin boundaries of different tributaries and project locations would be delineated with accuracy. Dr. Bhishm Kumar enquired about the display of database on the website being used in the project. It was informed that data of other organizations (IMD, CWC etc.) as such cannot be displayed. However, it is planned to put the abstract of data and the data availability on the website for use by researchers. It was conveyed that flow data of the study area is secret and undertaking to that effect is being taken from all users. BK opined that lots of isotopic data has been generated for the study area and all such data can be shared on website for use by various researchers.

The following sub-projects were briefly presented by the respective PIs.

**Sub-project – 2:** Real-time snow cover information system for Upper Ganga basin (PI-Mr. D. S. Rathore, Sc-F)

The progress of the project by briefly presented by Mr D. S. Rathore. No specific comments were received from members.

**Sub-project – 3:** Glacial Lakes & Glacial Lake Outburst Flood (GLOF) in Western Himalayan Region (PI-Dr. Sanjay K. Jain, Sc-G)

No specific comments were received from members.

**Sub-project – 6:** Hydrological modelling in Alaknanda basin and assessment of climate change impact (PI-Dr. A. K. Lohani, Sc-G and Co-PI-Dr. Sanjay K. Jain)

No specific comments were received from members.

**Sub-project – 4:** Assessment of downstream impact of Gangotri glacier system at Dabrani and future runoff variations under climate change scenarios (PI-Dr. Renoj J. Thayyen, Sc-D)

No specific comments were received from members.

**Sub-project – 5:** Observation and modelling of various hydrological processes in a small watershed in Upper Ganga basin (PI-Dr. Sharad K. Jain)

No specific comments were received from members.

**Sub-project – 11:** Water Census and Hotspot analysis in selected villages in Upper Ganga basin (PI-Dr. P. K. Mishra, Sc-C)

Results of the recent survey of 130 villages spread over four districts viz. Uttarkashi, Chamoli, Tehri Garhwal, and Pauri Garhwal were presented by Dr. P. K. Mishra (PKM). Dr. A. K. Saraf suggested to compare the findings from the survey with the available reports/ literature.

**PI: Dr. Renoj J Thayyen (RJT), Scientist “D”**

**1. *Catchment scale evaluation of cold-arid cryospheric system Hydrology, Ganglass catchment, Ladakh (Ongoing)***

RJT presented the background of the project and summarized how ground ice melt and permafrost processes to be found important for the catchment.

No specific suggestions received for this project.

**PI: Mr. D. S. Rathore, Scientist “F”**

**1. *Design and development of DSS (H) platform for Neeranchal National Watershed Project (Ongoing)***

The progress of the project was presented by Mr D.S. Rathore. The DSS- H is being developed under Neeranchal National Watershed Project for nine state level agencies under World Bank funded project of Department of Land Resources (DoLR), Government of India. The objective of the study is to develop a web-based Decision Support System platform for deriving hydrological information required in preparation of DPRs for watershed development. DSS- H has presently five modules, namely data visualization, planning, sites and structures, impact assessment and DPR inputs. Development of tools and user interface is in progress. Database are being stored on PostgreSQL. OSGeo Geoserver is being utilized for publishing spatial data. Various tools e.g. potential evapotranspiration (Penman Monteith method), water quality index, groundwater recharge (rainfall infiltration method), surface runoff (SCS curve number technique), design discharge (empirical method), soil erosion (RUSLE), site suitability for structures, livelihood vulnerability index etc. are developed and other tools e.g. irrigation water requirement etc. are under development. Dr Vimal Mishra inquired regarding agency for which the system being developed and location for deployment of DSS. Mr Rathore replied that the DSS- H is being developed for state level agencies working for IWMP. Presently the system is located at NIH and will be handed over to state level nodal agencies (SLNA) and DoLR in due course.

**2. *Investigating water stress using hydro-meteorological and remote sensing data (Ongoing study under NHP-PDS)***

The project was briefly introduced by Dr Sanjay Kumar Jain. The project is taken up for Rajasthan state. Due to changes in the study area, the project was delayed and same was also communicated by the PI to the NHP Secretariat. It is expected that some progress will be achieved by the time of the forthcoming working group meeting.

**PI: Shri M. K. Nema (MKN), Scientist “C”**

***1. Hydrological Processes and Characterization of Lesser Himalayan Catchments (Ongoing)***

The progress of the study was presented by MKN. It was informed that almost all proposed instrumentation like 03 No. of AWSs; 10 no. of SRGs, two gauging sites, one AWLR; Eddy covariance tower, one COSMOS sensor; two Pan Evaporimeter etc. have been installed in the experimental catchment and data is being received at NIH, Roorkee. Soil monitoring station has also been established at project site. Some of the preliminary data analysis of rainfall, air temperature, humidity, wind speed and direction, solar radiation and various soil parameters were also shown and discussed during the presentation.

No specific comments were received from the members.

**PI: Smt. Deepa Chalisgaonkar , Scientist “F”**

***1. Development of window based software for hydrological data processing and Unit Hydrograph Analysis (Ongoing)***

In the absence of Smt. Deepa Chalisgaonkar, Dr. Sanjay K. Jain informed about the progress of the study. In this study window based conversion of the existing software is progressing well.

**PI: Dr. M. Arora (MA), Scientist “D”**

***1. Modeling of Gangotri Glacier melt runoff and simulation of stream flow variation under different climate scenarios (Ongoing study)***

MA presented the progress of the study. The results for the study period 2014-2017 were presented before the experts.

No specific comments were received from the members.

**PI: Dr. P. K. Singh (PKS), Scientist “D”**

***1. Developments of Water Accounts for Subarnarekha Basin Using Water Accounting Plus (WA+) Framework (New study)***

PKS proposed the new study on Developments of water account for Subarnarekha basin using WA+ Framework. He briefly discussed the importance and relevance of global data used in WA+ as input. He also presented the different components under WA+ including the approach and methodology.

No specific comments were received from the members.

**PI: Dr. Vishal Kumar (VK), Scientist “C”**

***1. Real time flood modelling using HEC-RTS modelling framework (New study)***

VK proposed the new study on Real time flood modelling using HEC-RTS framework in Periyar river basin. He briefly presented the different components under HEC-RTS. He discussed about the recent Kerala flood events during the presentation.

No specific comments were received from the members.

**WORK PROGRAMME FOR THE YEAR 2018-2019**

<b>SN</b>	<b>Title</b>	<b>Study Team</b>	<b>Duration</b>	<b>Funding (Rs. in Lakhs)</b>
<b>Completed Sponsored/ Internal Studies</b>				
1.	NIH_Basin – A WINDOWS based model for water resources assessment in a river basin	M. K. Goel Sharad K. Jain Deepa Chalisgaonkar P. K. Mishra	3 years (04/13-12/17) Up to 06/2018	
<b>Ongoing Internal Studies</b>				
1.	Catchment scale evaluation of cold-arid cryospheric system Hydrology, Ganglass catchment, Ladakh	Renoj J. Thayyen S. P. Rai Sanjay K. Jain Sudhir Kumar	3 years (04/14-03/18) Up to 09/2018	
2.	Hydrological process and characterization of Lesser Himalayan Catchments	M. K. Nema Sharad K. Jain Sanjay K. Jain Renoj J.Thayyen P. K. Mishra P. K. Agarwal	5 years (12/14-12/19)	
3	Development of window based software for hydrological data processing and Unit Hydrograph Analysis	D. Chalisgaonkar A. K. Lohani M. K. Goel	1 year (04/18-03/19)	
<b>Ongoing Sponsored Studies</b>				
1.	Mass and Energy balance of Phuque and Khardung glaciers, Ladakh range	R.J. Thayyen Farooq Azam P.G. Jose A.P. Dimri	3 years (03/16-02/19)	SERB (65.14)
2.	Development of a project website and hydrological database in Upper Ganga Basin <b>(Sub-project – 1)</b>	M. K. Goel M. Arora A. K. Lohani D. S. Rathore D. Chalisgaonkar A. R. S. Kumar Surjeet Singh P. Mani A. Sarkar M. K. Nema P. K. Mishra	5 years (01/16-12/20)	DST (52.15)
3.	Real-time snow cover information system for Upper Ganga basin <b>(Sub-project – 2)</b>	D. S. Rathore D. Chalisgaonkar V. S. Jeyakanthan L. N. Thakural	5 years (01/16-12/20)	DST (48.83)
4.	Glacial Lakes & Glacial Lake Outburst Flood (GLOF) in Western Himalayan Region <b>(Sub-project – 3)</b>	Sanjay K. Jain A. K. Lohani Sudhir Kumar P. Thakur (IIRS)	5 years (01/16-12/20)	DST (36.79)
5.	Assessment of downstream impact of Gangotri glacier system at Dabrani and future runoff variations	Renoj J.Thayyen Sanjay K. Jain Sharad K. Jain	5 years (01/16-12/20)	DST 51.43 (NIH) + 28.29 (JNU)

	under climate change scenarios <b>(Sub-project – 4)</b>	S. P. Rai P. K. Mishra M. Arora AP Dimri (JNU)		
6.	Observation and modelling of various hydrological processes in a small watershed in Upper Ganga basin <b>(Sub-project – 5)</b>	Sharad K. Jain Renoj J.Thayyen Sanjay K. Jain S. P. Rai Surjeet Sing M. K. Nema P. K. Mishra P. K. Agarwal AP Dimri (JNU)	5 years (01/16-12/20)	DST (54.07)
7.	Water Census and Hotspot analysis in selected villages in Upper Ganga basin <b>(Sub-project – 11)</b>	P. K. Mishra M. K. Nema R. J. Thayyen P. K. Sachan	5 years (01/16-12/20)	DST (90.99)
8.	Dynamics of Himalayan Ecosystem and its impact under changing climate scenario-Western Himalaya	Renoj J.Thayyen P. K. Mishra	3 years (03/17-03/19)	NMHS-MoEF (58.76 lakh)
9.	Measurements and Modeling of Evapotranspiration and other Hydrological Processes in Lesser Himalayas	M K Nema Renoj Thayyen Sharad K. Jain Sanjay K. Jain P. K. Mishra AP Dimri (JNU)	3 years (2016-19)	MOES (Rs. 98 Lakh)
10.	Sustaining Himalayan Water Resources in a Changing Climate (SusHi-Wat)	Sanjay K. Jain (PI) Sharad K. Jain CSP Ojha (PI, IITR)	3 years (2016-2019)	MOES-NERC, Newton- Bhabha project (11.59 Lakh)
11.	Design and development of generic Decision Support System- Hydrology platform for Neeranchal Project	D. S. Rathore Deepa Chalisgaonkar Jyoti Patil	1 year (04/17-03/19)	DoLR (NNWP)
12.	Investigating Water Stress using Hydro-meteorological and Remote Sensing data	D. S. Rathore L. N. Thakural Sanjay Kumar B. Venkatesh M. K. Jose T. Chandramohan	3 years 2017-2020	PDS under NHP
13.	Seasonal Characterization of Gangotri Glacier melt runoff and simulation of streamflow variation under different climate scenarios	M. Arora Sanjay K. Jain	3 years 2018-2021	NIH/ DST
<b>New Internal/ Sponsored Studies</b>				
1.	Developments of Water Accounts for Subarnarekha Basin Using Water Accounting Plus (WA+) Framework	P. K. Singh P. K. Mishra M. K. Goel Suman Gurjar	2 years 2018-2020	
2.	Real time flood modelling using HEC-RTS modelling framework	Vishal Kumar A. K. Lohani Sanjay K. Jain	2 years 2018-2020	

**RESEARCH MANAGEMENT AND OUTREACH DIVISION (RMOD)**

**WORK PROGRAMME FOR 2018-2019**

SN	Title of Project/Study, Study Team	Status and Recommendations/Suggestions
1.	<p><b>Study on effect of climate change on sediment yield to Pong reservoir.</b></p> <p><b>Team:</b> A. R. Senthil kumar, J. V. Tyagi, S. D. Khobragade and Manohar Arora</p> <p>DOS: Apr 2015, DOC: September 2018</p>	<p>The objectives, brief methodology and present status of the study were presented by Dr A. R. Senthil Kumar (PI). The PI mentioned that the discharge and sediment yield at Nadaun Brdige (Pong reservoir) was simulated using SWAT using the data from 1993 to1996 for calibration and 1999 to 2002 for validation. The downscaling of rainfall for the scenarios RCP2.6, 4.5 and 8.5 were carried using SDSM from CanESM2. The downscaling of the data was done by the IMD gridded data from 1961 to 1995 for calibration and 1996 to 2005 for validation. Prof Vimal Mishra suggested to consider more GCM models to address the uncertainty in the downscaled data. Dr. D. K. Singh suggested to use APHRODITE rainfall data in addition to the data of IMD and ERA Interim. He aslo suggested to use SWAT CUP for the calibration of SWAT paramters to get the realistic values related to catchment and meteorological properties.</p>
2.	<p><b>Bathymetric survey and water quality monitoring of selected ponds in Bundelkhand region for development of water management plan.</b></p> <p><b>Team:</b> Digambar Singh, Omkar Singh, Subhash Kichlu, Rajesh Kumar Nema, Hukum Singh and N R Allaka</p> <p>DOS: Apr 2018, DOC: March 2020</p>	<p>Shri Digambar Singh (PI) presented the objectives, methodology and progress related to the study. Dr. A K Saraf advised to include the ponds of Lalitpur district for the survey.</p>
3.	<p><b>Conservation of ponds in Ibrahimpur-Masahi Village and performance evaluation of natural treatment system</b></p> <p><b>Team:</b> Omkar Singh, V C Goyal, Rajesh Singh, Digambar Singh, Subhash Kichlu, Rajesh Agarwal, Rakesh Goyal &amp; N R Allaka</p> <p><b>Partner Organization:</b> Centre for Ecology &amp; Hydrology, Edinburgh, United Kingdom.</p> <p>DOS: Apr 2018, DOC: March 2020</p>	<p>The objectives, methodology and progress was presented by Sh. Omkar Singh (PI). The PI infomed that the necessary data collection including data on GHG emissions (viz. methane) from the pond with CW-NTS at Ibrahimpur Masahi and another control pond at Masahi Kala has been initiated in technical collaboration with CEH-UK team. There were no specific comments from working group members.</p>
4.	<p><b>Vulnerability assessment of identified watersheds in Neeranchal Project</b></p>	<p>The study was presented by Dr Jyoti P Patil (PI). The results of the Jashpur and Kanker district by</p>

	<p><b>States</b></p> <p><b>Team:</b> Dr Jyoti P Patil and nodal scientists from Regional centres (Bhopal, Patna, Kakinada, Belgaum)</p> <p>DOS: July 2017, DOC: June 2019 (<b>NNWP</b>)</p>	<p>LVI-IPCC approach on block level assessment were presented. Moreover, results by composite LVI methodology on watershed scale were also presented. It was informed that the computation methodology will be incorporated in Decision Support System- Hydrology (DSS-H) under Neeranchal project. The committee member asked about source of village/ district boundaries consider in the computation. In her reply, it was informed that spatial data for village/ district boundaries from Survey of India is under procurement, at present the data provided by State Level Nodal Agencies (SLNA) is considered for this study. There were no specific comments on results of the study.</p>
5.	<p><b>Hydrological modelling in Bhagirathi basin up to Tehri dam and assessment of climate change impact</b></p> <p><b>Team:</b> A R Senthil kumar, J. V. Tyagi, M. K. Goel, S. D. Khobragade, P. C. Nayak, Manohar Arora and Digambar Singh</p> <p>DOS: July 2016, DOC: June 2021 (<b>NMSHE</b>)</p>	<p>The objectives, brief methodology and present status of the study were presented by Dr. A. R. Senthil kumar (PI). The PI mentioned that the discharge and sediment yield at Tehri dam was simulated using SWAT by considering the parameters randomly initially and input data obtained/generated from different sources such as, NASA, BHUVAN NRSC, NBSSLUP, ECMWF. The parameters for the simulation of discharge were calibrated using SWAT CUP and the data from 2001 to 2013 and the meteorological data from both IMD and ERA Interm (ECMWF). Dr. D. K. Singh inquired about the range of parameters. The PI mentioned that the results during calibration and validation measured by the performance indicators were poor because of poor quality of hydro-meteorological data. The chairman suggested to contact THDC authority to get good quality data.</p>
6.	<p><b>Development of water allocation plan for a Neeranchal watershed in Chhattisgarh</b></p> <p><b>Team:</b> A. R. Senthil Kumar, Jyoti P Patil, T R Nayak and Rajesh Agarwal</p> <p>DOS: Apr 2018, DOC: March 2020</p>	<p>The objectives, methodology and status of the study were presented by Dr. A. R. Senthil kumar (PI). PI mentioned that the WEAP model has been setup for micro watersheds IWMP14, IWMP15 and IWMP16 of Kanker District, Chhattisgarh. The climate data was downloaded from WEAP site. Model outputs such as water demand, runoff generated, demand site inflows and outflows, unmet demand, reliability of demand met were presented for the period from 2008 to 2025. Dr. D. R. Sena inquired about the method used in the computation of runoff. The PI informed that the runoff was computed by the soil moisture model of WEAP.</p>
7	<p><b>Rejuvenation of village ponds for identified villages in Muzaffarnagar and Meerut districts</b></p> <p><b>Team:</b> V C Goyal, Omkar Singh, Rajesh Singh, Digambar Singh</p>	<p>The objectives, brief methodology and present status of the civil work related to rejuvenation of ponds, being taken up by NPCC Ltd., was presented by Er. Omkar Singh. There were no specific comments from working group members.</p>

	<p><b>Scientific/Technical Staff:</b> Subhash Kichlu, Rajesh Agarwal, Rakesh Goyal, N. R. Allaka, N. G. Shrivastava, Nihal Singh, Kalzang Mathus, Sandeep Yadav, Subhash Vyas DOS: April 2017, DOC: March 2020</p>	
8	<p><b>Rejuvenation of Village Ponds in Identified Villages of Baghpat, Ghaziabad and Meerut Districts of Uttar Pradesh</b></p> <p><b>Team:</b> Omkar Singh, Rajesh Singh, V. C. Goyal, Digambar Singh <b>Scientific/Technical Staff:</b> Subhash Kichlu, Rajesh Agarwal, Rakesh Goyal, N. R. Allaka, N. G. Shrivastava, Nihal Singh, Kalzang Mathus, Sandeep Yadav, Subhash Vyas DOS: March 2018, DOC: March 2021</p>	<p>Er Omkar Singh (PI) informed that the civil work for rejuvenation work of ponds under this project has been initiated, and baseline data collected during field investigations was presented. There were no specific comments from working group members.</p>

Dr. V C Goyal thanked the members for their valuable contributions during deliberations in the Working Group meeting.

The meeting ended with vote of thanks to the Chair.

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## ANNEXURE-I

### List of Working Group Members who attended the 47<sup>th</sup> WG meeting

1.	Dr. S.K. Jain, Director, NIH	Chairman
2.	Sh. S K Manik, IMD, New Delhi	Member
3.	Dr. D R Sena, ICAR-IISWC, Dehradun	Member
4.	Dr. D K Singh, ICAR-IARI, New Delhi	Member
5.	Dr. U K Sinha, BARC, Mumbai	Member
6.	Dr. M J Nandan, CSIR-NGRI, Hyderabad	Member
7.	Dr. S P Aggarwal, IIRS, Dehradun	Member
8.	Dr. George, Abe, CWRDM, Kottayam	Member
9.	Prof. Vimal Mishra, IIT Gandhinagar	Member
10.	Prof. K K Singh, Kurukshetra	Member
11.	Prof. A K Saraf, IIT, Roorkee	Member
12.	Prof. M L Kansal, IIT, Roorkee	Member
13.	Dr. Bishm Kumar, IAEA (Retd.), Roorkee	Member
14.	Dr. Sadhana Malhotra, Mindspace, Dehradun	Member
15.	Dr. N C Ghosh, Sc.G & Head GWH Division, NIH	Member
16.	Dr. Rakesh Kumar, Sc. G & Head SWH Division, NIH	Member
17.	Dr. C K Jain, Sc.G & Head EH Division, NIH	Member
18.	Dr. Sudhir Kumar, Sc. G & Head HI Division, NIH	Member
19.	Dr. Sanjay K. Jain, Sc. G & Head WRS Division, NIH	Member
20.	Dr. V C Goyal, Sc. G & Head, RMO Division, NIH	Member-Secretary

### Scientists from National Institute of Hydrology

	<b>EH Division</b>		<b>SWH Division</b>
1	Dr. M.K. Sharma, Sc.D	19	Dr. J.V. Tyagi, Sc.G
2	Dr. Rajesh Singh, Sc.C	20	Dr. A.K. Lohani, Sc.G
3	Dr. Pradeep Kumar, Sc.C	21	Dr. R.P. Pandey, Sc.G
4	Dr. Swapnali Barman, Sc.C	22	Dr. S.K. Singh, Sc.F
	<b>GWH Division</b>	23	Dr. Sanjay Kumar, Sc.E
5	Er. C.P. Kumar, Sc.G	24	Dr. Archana Sarkar, Sc.D
6	Dr. Anupama Sharma, Sc.E	25	Dr. L.N. Thakural, Sc.C
7	Dr. Surjeet Singh, Sc.E	26	Sh. J.P. Patra, Sc.C
8	Er. Sumant Kumar, Sc.C	27	Dr. Ashwini A. Ranade, Sc.C
9	Smt. Suman Gurjar, Sc.C	28	Sh. Sunil Gurrapu, Sc.C
10	Dr. Gopal Krishan, Sc.C	29	Sh. N.K. Bhatnagar, Sc.B
	<b>HI Division</b>		<b>WRS Division</b>
11	Dr. Suhas Khobragade, Sc.F	30	Dr. M.K. Goel, Sc.G
12	Dr. M.S. Rao, Sc.E	31	Smt. Deepa Chalisgaonkar, Sc. F
13	Sh. S.K. Verma, Sc.D	32	Er. D.S. Rathore, Sc.F
14	Dr. S M Pingale, Sc.C	33	Dr. Renoj J. Thayyen, Sc.D
	<b>RMO Division</b>	34	Dr. Manohar Arora, Sc.D
15	Er. Omkar Singh, Sc.F	35	Dr. P.K. Singh, Sc.D
16	Dr. A R Senthil Kumar, Sc.E	36	Sh. Manish Nema, Sc.C
17	Sh. Digamber Singh, Sc.C	37	Dr. P.K. Mishra, Sc.C
18	Dr. Jyoti P. Patil, Sc.C	38	Dr. Vishal Singh, Sc.C
		39	Sh. P.K. Agrawal. Sc.B